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REPLY ESSAYS

HOW GOOD IS GOOD ENOUGH?: EXPERT EVIDENCE UNDER *DAUBERT* AND *KUMHO*

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*"Trials would be very short if only perfect evidence were admissible."*¹

In a recent article published in this Review, Professor Edward Imwinkelried accused us of producing "mischief" by "apparently" proposing or "strongly suggesting" in our treatise, *Modern Scientific Evidence: The Law and Science of Expert Testimony*,² a "best evidence rule" for expert testimony.³ In response, we have two basic points.⁴ First, we wish to make it clear that we never proposed the "best evidence" rule that he so vigorously attacks, and we think his suggestion that we did so is strained.⁵ Indeed, we share Professor Im-

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¹ *Indianapolis Colts v. Metropolitan Baltimore Football Club*, 34 F.3d 410, 416 (7th Cir. 1994) (Posner, J.).

² 1 DAVID L. FAIGMAN ET AL., *MODERN SCIENTIFIC EVIDENCE: THE LAW AND SCIENCE OF EXPERT TESTIMONY* (1997 & Supp. 1999).

³ See Edward J. Imwinkelried, *Should the Courts Incorporate a Best Evidence Rule Into the Standard Determining the Admissibility of Scientific Testimony?: Enough Is Enough When It Is Not the Best*, 50 CASE W. RES. L. REV. 19, 23-24 (1999) (arguing against the creation of a "best evidence" rule for expert witness testimony).

⁴ Though we lock horns with Professor Imwinkelried on this occasion, we hold the remarkable body of evidence scholarship that he has produced in the very highest regard. We have learned enormously from his many books and articles, as well as his informed, careful thinking. Without his efforts, our own evidence scholarship, and that of countless other scholars and practitioners, would not be as advanced as it is.

⁵ We have not proposed a "best evidence" rule any more than Professor Imwinkelried has proposed an "any evidence" rule.

winkelried's view that such a rule would be unwise. But few, if any, courts have enunciated, endorsed, or applied such a rule, and no commentators we are aware of have proposed such a rule, so there is little reason for concern.

Second, we want to reiterate that courts sometimes should do more than they have to ensure that expert testimony is reasonably sound.⁶ In this regard, we differ with Professor Imwinkelried as to exactly how high the courts should position the bar to dubious expert testimony. The important debate underway in the courts and the law reviews concerns the contours of the "better evidence" principle that the Supreme Court has placed between experts and the witness stand. The question that needs to be answered is this: How much better is good enough?

I. OUR POSITION AS TO A "BEST" EXPERT EVIDENCE RULE

Professor Imwinkelried argues that we think that expert evidence ought not to be admitted unless it is "the best" of its particular genre that can be obtained, imputing a sort of "best evidence" rule for expert witnesses to our most recent treatise. Professor Imwinkelried expresses "mild surprise" that we "seemingly proposed to extend the rule to a new setting"⁷ We are also surprised to learn of this, for nowhere in the 2,372 pages of our volumes and supplements did we use the words "best evidence," and we did not and do not believe such a rule exists or that it would be wise or workable.⁸ Indeed, it is hard to imagine what a "best evidence rule" would look like in the expert evidence context.⁹

⁶ In appropriate cases we applaud those courts that have done so, including the United States Supreme Court.

⁷ Imwinkelried, *supra* note 3, at 21.

⁸ As Professor Imwinkelried explains in his article, shortly after the Supplement was published he e-mailed one of us, asking whether we intended to advocate a best evidence rule for expert testimony. He uses this e-mail in his article, although it disclaims any pretension to create a best evidence rule for experts. *See id.* at 23 n.38. To be sure, it makes the somewhat flippant point that our intention was to create a "best evidence rule, with a vengeance." *Id.* But, read in context, the two points being made are the points made below regarding the "better evidence principle." First, that the best evidence rule is contextually so unlike expert testimony that it cannot provide any sort of model by which to structure an expert evidence rule. Second, unlike many situations with documents, courts actually have the opportunity to expect, and maybe even demand, better evidence than currently exists. Possibly the more salient lesson here concerns the technology of e-mail. Words composed in a moment, and sent off in an instant, with little thought of their longevity as they blinked off into the great unknown of cyberspace, might yet find immortality in the annals of the law.

⁹ The only thing that expert testimony has in common with written documents is that the rules concerning the two have at their core a concern with accuracy. The same could be said of all types of evidence. The rules are designed to promote the production of reliable evidence at reasonable cost. *See* Richard A. Posner, *An Economic Approach to the Law of Evidence*, 51 STAN. L. REV. 1477, 1478 (1999) (proposing a cost-benefit model for restructuring evidence law). The issue, then, is how should the rules evaluate reliability for different kinds of evidence. On this question, documents and experts have precious little in common. From a perspective of

Professor Imwinkelried explains the basis of his inference that we urge a “best evidence” rule for the admissibility of expert testimony in the following paragraph:

[There are passages in the 1999 Supplement] which suggest a proposal to incorporate a best evidence principle into admissibility analysis under *Daubert*. In one passage, the authors argue that the proponent’s characterization of the proffered testimony should not be dispositive of the issue of which evidentiary restrictions apply to the testimony. Rather, in two other passages, the authors state that the trial judge should focus on “the nature of the legal question to be answered” or the “legally relevant issues.” These passages are reminiscent of the language in Holt, Gilbert, and Blackstone that the trial judge should look to the nature of the issue to be resolved. After the judge has focused on that question, Professor Faigman and his colleagues urge that “courts should, wherever possible, adopt admissibility criteria that encourage expert communities to develop the best possible information on legally relevant issues.” Employing a market metaphor, the authors state that like “a good consumer, [the judge] can demand and receive a quality product.” These passages echo the insistence by Holt, Gilbert, and Blackstone that the proponent tender the best evidence.¹⁰

We think that the fair import of our words, especially in their context, does not support Professor Imwinkelried’s interpretation. We can think of no better way to demonstrate this than to provide the relevant language and let the reader decide:

In the post-*Daubert* world, courts approaching the problem of experts who did not fit snugly into the “scientific” box have tended to characterize the nature of the testimony as “science” or “nonscience.” If the expert did not testify about scientific research, then it was not “scientific evidence.” This was the approach taken by the Eleventh Circuit. The problem with this strategy is readily apparent. An expert’s testimony might be characterized as non-science for various reasons. It might not, and perhaps never could, be the subject of science. Or the underlying science could be so well settled that only a specialist or technician is really needed in court. Or possibly

evidence law, not to mention epistemology, ensuring that evidence of the contents of documents is accurate involves very different criteria than determining, say, whether Bendectin causes birth defects.

¹⁰ Imwinkelried, *supra* note 3, at 22-23 (citations omitted).

the expert seeks to testify from experience to a conclusion that scientific research contradicts.

The Eleventh Circuit chose to let the witness's own characterizations determine whether it was science, thus making no effort to distinguish between the various reasons for the presence of a nonscientist expert. The Eleventh Circuit relied on an aside by the Seventh Circuit in *Berry v. City of Detroit*. The *Berry* court discussed what constitutes scientific testimony in the following passage:

[I]f one wanted to explain to a jury how a bumblebee is able to fly, an aeronautical engineer might be a helpful witness. Since flight principles have some universality, the expert could apply general principles to the case of the bumblebee.

On the other hand, if one wanted to prove that bumblebees always take off into the wind, a beekeeper with no scientific training at all would be an acceptable expert witness if a proper foundation were laid for his conclusions. The foundation would not relate to his formal training, but his firsthand observations. In other words, the beekeeper does not know any more about flight principles than the jurors, but he has seen a lot more bumblebees than they have.

Several common sense insights drive the bumblebee example. The first is that when expert testimony is not scientific, it is less likely to cast a spell of certainty over the subject and overwhelm the trier of fact. Second, this example illustrates the fact that people learn from experience. Although there is much truth in these common sense insights, they provide only a part of the picture.

First, overwhelming the trier of fact is not the only danger associated with expert testimony. There are a score of other concerns associated with experts who lack a reliable basis for their opinion, ranging from their introducing evidence that is otherwise inadmissible to prolonging litigation and wasting time and resources. Moreover, although it is likely that "scientists" might cast a spell of certitude, many other experts might do the same. If jurors are so susceptible to the "scien-

tist" label — which is an assertion with little proof — then they are likely to be similarly affected by the "expert" label.

There are two additional, and more profound, problems with the Eleventh Circuit's approach to expert testimony in *Kumho*. The first is the relatively straightforward lesson of history that common sense about the empirical world — even that based on extensive experience — is often wrong. The second, and considerably less straightforward, problem concerns the question of when experience is enough.

We need not dwell on the lesson that experience has often proved wrong, sometimes astoundingly so, in describing the empirical world. Examples abound. The sun does not revolve around the earth; leeches are not an effective medical therapy; the paraffin test does not uniquely identify gunpowder residue; and Bendectin does not cause birth defects. It is similarly possible that bumblebees do not "always" take off into the wind. Maybe they take off toward the nearest food source, which happens to be usually associated with wind direction. The scientific method was developed to put common sense to more rigorous tests.

This leads to the second issue, and ultimately the crux of the matter. The Eleventh Circuit erred when it attempted to establish admissibility rules based on the nature of the testimony (i.e., is it science based) rather than the nature of the legal question to be answered by the testimony. The bumblebee example helps to clarify this point. It is not the case that bumblebee behavior is not the subject of science. Obviously, it is. Entomologists know a great deal about bees. But, then again, so do beekeepers. By focusing the admissibility issue solely on the question of whether the expert is an entomologist or a beekeeper, the court appears to afford the latter a wide latitude it would not permit from the former. The limited utility of this approach becomes manifest if we substitute a medical doctor or a psychologist for a beekeeper. The Eleventh Circuit's rule would appear to permit a surfeit of clinical medical opinion to be admitted irrespective of the availability, or possibly even in the teeth of contradictory findings, of epidemiological or toxicological research. Similarly, this approach would allow untested syndromes and other psychological exotica to be introduced regardless of the availability of empirical research. After all, to paraphrase the Eleventh

Circuit, medical doctors and psychologists have seen a lot more patients than jurors have.

The issue for the law of evidence is whether a beekeeper is *good enough*. This is a component of what the *Daubert* Court referred to as "fit." As the Court explained, "Rule 702's 'helpfulness' standard requires a valid scientific connection to the pertinent inquiry as a precondition to admissibility." Although the Court used a fanciful example, it actually well illustrates the point that underlying the admissibility determination lies the policy judgment of how demanding courts should be regarding the level of experience or the amount of research that is necessary before testimony will be allowed. "The study of the phases of the moon," the Court suggested,

[M]ay provide valid scientific "knowledge" about whether a certain night was dark, and if darkness is a fact in issue, the knowledge will assist the trier of fact. However (absent creditable grounds supporting such a link), evidence that the moon was full on a certain night will not assist the trier of fact in determining whether an individual was unusually likely to have behaved irrationally on that night.

The Court's example assumes, for good reason, that an expert could be found that would testify that a full moon adversely affected a particular individual. Further, such testimony would undoubtedly be based on "clinical experience." But it would not be "credible." Experience in this case should not be enough, even if the expert disavowed any pretensions to testifying about "scientific knowledge."

Yet, experience sometimes is enough, particularly when no more is available and no more can be expected. The law is an intensely practical discipline. A court might not permit a medical doctor to testify that, in his experience, drug X causes cancer, because it expects such opinion to be backed by creditable research, perhaps involving toxicological and epidemiological studies. The court, however, might permit a surgeon to testify, based on experience, that patients get nervous before operations. It is not that this fact is not subject to general testing, since it might be that *this* doctor's bedside manner or the types of operations he performs are responsible for the observation. Instead, the court is making the policy

judgment that the law demands no more. Auto mechanics, accountants, electricians and plumbers testify routinely pursuant to this implicit judgment.

This sort of fit analysis goes far in focusing attention, and possibly solving, another difficulty that has arisen over the issue of the reach of *Daubert*. Defining the gatekeeping function as solely applicable to scientific evidence led practitioners in several fields (with courts' acquiescence) to disclaim the science label in order to have their testimony admitted. This implied the possibility that all ostensibly scientific experts who failed to test their hypotheses could still qualify as experts based on experience. Even more disturbing, it suggested that the best way to continue to testify would be to refrain from conducting any research at all, for that would suggest *Daubert* might be applicable. This illustrates an important lesson that has so far been given little attention by judges and commentators. The law is itself a marketplace for experts — scientific, technical, specialized and pseudo. As in most markets, if the law proves to be a bad consumer, it is more likely to get a bad product. But, if it is a good consumer, it can demand and receive a quality product.¹¹

We did not intend, and we expect that readers will not find, a "best evidence" test suggested in this language. At the same time, our words do reflect our view that *Daubert v. Merrell Dow Pharmaceuticals, Inc.*,¹² *General Electric Co. v. Joiner*,¹³ and *Kumho Tire Co. v. Carmichael*¹⁴ require *better* evidence than has been the practice of many courts to demand, and that the Supreme Court's raising of the threshold to admission is a good thing.¹⁵ Before elaborating on this position, however, it might be helpful to say something about the rhetorical strategy that requires us to provide this reply. Professor Imwinkelried concludes that despite our failure to use the term "best evidence," or to urge courts to admit none but the best possible evidence, that is what we meant. He then finds that the best evidence rule is anachronistic and no longer suited even to the original context in

¹¹ 1 FAIGMAN ET AL., *supra* note 2, § 1-3.4, at 12-15 (Supp. 1999) (citations omitted).

¹² 509 U.S. 579 (1993) (overturning the *Frye* "general acceptance" test for admissibility of scientific expert testimony).

¹³ 522 U.S. 136 (1997) (rejecting testimony that connected the underlying data to a conclusion with nothing more than speculation by the expert).

¹⁴ 526 U.S. 137 (1999) (extending the *Daubert* analysis to all "expert" testimony).

¹⁵ The quoted passage that troubles Professor Imwinkelried pre-dates the Supreme Court's opinion in *Kumho*. But it obviously is discussing *Kumho* in the courts below, and its reasoning closely parallels the Supreme Court's eventual opinion in *Kumho*.

which it was used. The lesson is that anyone who would advocate a best evidence rule in a new context, after it was so thoroughly routed in its original context, is out of step with the development of evidence doctrine. Unfortunately, this substitutes a side-show for the main event and eludes the real debate.¹⁶ The main event involves the more difficult question that courts must face under *Daubert*, *Joiner*, and *Kumho*: How dependable must expert evidence be to be good enough for admission? In the next section, we show that this question does not relate to the classical best evidence rule but is illuminated by a more flexible and pervasive "better evidence" principle.

II. THE ORIGINAL WRITING RULE, THE BEST EVIDENCE RULE, AND THE BETTER EVIDENCE PRINCIPLE

To understand Professor Imwinkelried's charge and our response, it is necessary to distinguish among three possible "best evidence" rules or standards: (1) the current rule, which pertains to original writings; (2) an implausible rule that excludes all but the best

¹⁶ Professor Imwinkelried used the same rhetorical strategy in criticizing the *Daubert* opinion itself. See Edward J. Imwinkelried, *The Next Step After Daubert: Developing a Similarly Epistemological Approach to Ensuring the Reliability of Nonscientific Expert Testimony*, 15 CARDOZO L. REV. 2271, 2277 (1994) (arguing that in suggesting how to evaluate expert scientific evidence, the Supreme Court employed criteria that work only for "Newtonian experimental science").

By characterizing *Daubert* as being suited only to "Newtonian" sciences, one can say that *Daubert* is unsuited to the many fields and subjects of inquiry that are not "Newtonian." But why Newton? Why not "Baconian empirical science?" Although the ideas of Sir Francis Bacon are more seminal to the scientific method, they also are broader and more flexible and therefore would be the wrong tool for the rhetorical job.

Nevertheless, other critics of *Daubert* have put Imwinkelried's criticism to use:

Recent years have seen a proliferation of commentary on the new rules that govern the admissibility of "scientific evidence." The definitions of "science," "scientific evidence," and "forensic science" as viewed by courts and commentators are as diverse and inconsistent as the Supreme Court's definition of "scientific knowledge" is incomplete and unworkable for all but a few Newtonian experimental science endeavors. The Court's view of "scientific knowledge," arguably correct as far as it went, is woefully inadequate to deal with a myriad of specialties to which it is sought to be applied.

Andre A. Moenssens, *Handwriting Identification Evidence in the Post-Daubert World*, 66 UMKC L. REV. 251, 252 (1998). However, these critics are beating the Supreme Court with a straw club. The *Daubert* "factors" are not limited to "Newtonian experimental science." They are easily applicable to all fields of empirical inquiry. Indeed, the science involved in *Daubert* was epidemiology, a non-Newtonian discipline that relies on correlational studies rather than experiments. Contrary to the implication of the "Newtonian experimental science" charge, *Daubert* simply invites trial courts to ask whether empirical claims are (1) testable, and have been tested; (2) by tests of adequate design whose assessment can be aided by peer review and publication; and to ask (3) what findings they have produced. These suggested evaluation criteria are applicable to empirical claims of any sort. Moreover, as interpreted in *Kumho*, *Daubert* stands for the more general proposition that expert evidence of infinite variety must be proven to be reliable. As courts confront proffered expert evidence of various kinds, they must find appropriate criteria for evaluating the soundness of those offerings.

conceivable evidence on any proposition; and (3) a principle that allows courts or rule-makers to consider the admissibility of evidence in the light of what alternative evidence might be produced by the parties or generated by a different rule.

The best evidence rule is more aptly named the "Original Document Rule."¹⁷ Indeed, a more precise appellation would be "the preference for the original writing rule." As McCormick explains, "[t]he rule is this: in proving the terms of a writing, where the terms are material, the original writing must be produced unless it is shown to be unavailable for some reason other than the serious fault of the proponent."¹⁸ Many justifications have been offered for the rule, but all are concerned with ensuring that the judge or jury receives the precise words of a written document, particularly instruments such as deeds, wills, and contracts.¹⁹ A witness's memory of what was written, or a handwritten copy, might contain subtle errors that would alter the meaning. Even a photocopy lacks indicia of putative fraud such as watermarks, types of paper, and ink.²⁰ For such reasons, the courts have insisted on the production of original writings when they are available or when the fidelity of the copy is questioned.²¹

Professor Imwinkelried fears we are proposing that the courts become similarly demanding when it comes to the testimony of expert witnesses. A "best evidence" rule for experts would admit the testimony only of those whose fields had produced the best possible knowledge that currently could be produced. And even in these fields it would admit the testimony only of those experts who apply that knowledge in the best possible way to the case at bar. Again, we plead not guilty to the charge of making such a proposal.

In contrast to the narrow best evidence rule is a much more general notion that arguably underlies and animates many rules of evidence. As Professor Dale Nance has argued forcefully,²² this more general principle holds that in devising or applying rules of evidence, it is appropriate to consider whether better evidence is available at

¹⁷ See Imwinkelried, *supra* note 3, at 20 (endorsing the characterization of the best evidence rule proposed in 2 CHARLES T. MCCORMICK, MCCORMICK ON EVIDENCE § 229, at 61 (John William Strong et al. eds., 4th ed. 1992)).

¹⁸ 2 CHARLES T. MCCORMICK, MCCORMICK ON EVIDENCE § 230, at 61 (John William Strong et al. eds., 4th ed. 1992).

¹⁹ *Id.* § 231, at 62.

²⁰ *Id.* § 236, at 74.

²¹ Citing the work of a California law revision commission, Professor Imwinkelried denigrates the traditional rule as "under attack." See Imwinkelried, *supra* note 3, at 20 ("Even in [its] limited, diminished form, the [best evidence] rule is under attack."). We suspect that the rule is applied with sufficient flexibility to avoid serious injustices, but we shall not pursue that topic here.

²² See Dale A. Nance, *The Best Evidence Principal*, 73 IOWA L. REV. 227 (1988) (arguing in support of a best evidence principal and analyzing its possible applications).

reasonable cost.²³ This overarching principle manifests itself in protean forms. For example, in justifying the rule against character evidence, Professors Lempert and Saltzburg point to the fact that other, more probative, evidence of a party's conduct generally should be available.²⁴ In passing on the admissibility of pretrial experiments, courts often assert that the experiment must be "substantially similar" to the conditions of the litigated event. However, what constitutes substantial similarity is all but impossible to discern from the case law without inquiring into the possibility that a better experiment could have been done.²⁵ The best explanation of the results in these cases seems to be that "whenever the marginal benefits of a more refined experiment do not exceed the marginal costs, and the experiment is probative, the substantial-similarity requirement should be deemed satisfied."²⁶

Although we reject a *best evidence rule* for expert evidence, we do endorse a *better evidence principle* in our analyses of *certain* issues in the law of expert testimony. That is to say, we believe that there are circumstances in which a court properly may exclude proffered evidence when other evidence of greater probative value is or should be available. Before we explicate this idea more fully, we need to be clear about what the better evidence principle does *not* mean. To say that attention may be paid to alternatives is not to say that evidence must be excluded because it is not "the utmost Evidence, the Nature of the Fact is capable of . . ."²⁷ It is not to say that eyewitness testimony should be excluded because DNA evidence could have been presented, that lay witnesses may not express opinions on sanity, or any of the other examples that Professor Imwinkelried presents to show that there is no rigid hierarchy of types of evidence.²⁸ Our position is far less formulaic. We merely maintain that in deciding when an expert has knowledge that is sufficiently probative and helpful to

²³ See Posner, *supra* note 9 (suggesting a cost-benefit model for the admissibility of evidence).

²⁴ See RICHARD O. LEMPERT & STEPHEN SALTZBURG, A MODERN APPROACH TO EVIDENCE 237 (2d ed. 1983) (referring to the often minimal, "incremental relevance" of character evidence).

²⁵ See 1 CHARLES T. MCCORMICK, MCCORMICK ON EVIDENCE § 202, at 720-26 (John William Strong et al. eds., 5th ed. 1999) (discussing the "substantial similarity" standard generally and various approaches the judiciary has taken in applying it during trial).

²⁶ *Id.* at 724; see also *id.* at 722 ("If enough of the obviously important factors are duplicated in the experiment, and if the failure to control other possibly relevant variables is justified, the court may conclude that the experiment is sufficiently enlightening that it should come into evidence."). Lest we be accused of bootstrapping, we should acknowledge that these words come from one of us in his capacity as a contributing author of MCCORMICK ON EVIDENCE. We should also acknowledge that although Professor Imwinkelried is a co-author of that volume, he was not responsible for and does not necessarily concur with that analysis.

²⁷ GEOFFREY GILBERT, THE LAW OF EVIDENCE 3-4 (Dublin, Sarah Cotter 1754).

²⁸ See Imwinkelried, *supra* note 3, at 29-33 (presenting several examples that demonstrate there is no general preference for scientific expert testimony over lay testimony).

the jury to be admitted, a court should consider whether the expert's putative knowledge comes from procedures that have been shown to be valid, and, if not, why not. In other words, in asking whether scientific or other expert evidence is good enough for the courtroom, and in devising criteria for answering this question, we think it sometimes is advisable to inquire into what might reasonably have been done to make the evidence better. This thought does not strike us as especially radical, and in the vast majority of cases in which expert evidence is proffered, the better evidence principle would not alter the admissibility decision. While the better evidence principle reflects a fundamental choice concerning how the law of evidence should interact with scientific information, it is a principle that works on the margins.

III. THE *DAUBERT* REVOLUTION

Professor Imwinkelried correctly senses that we sometimes would set the standard higher than he would. But it seems to us that much of his complaint is not that we have proposed an extreme and unworkable test, but rather that we have welcomed the qualitatively new test embodied in the Supreme Court's three scientific evidence admissibility opinions and that we welcome the fact that the new test sometimes sets the barrier to admissibility higher than Professor Imwinkelried thinks it should be set. Indeed, his quarrel seems to be not with us so much as it is with *Daubert*, *Joiner*, *Kumho*, and the hundreds of cases that are following and fleshing out their import. Because Professor Imwinkelried disagrees with *Daubert* and its progeny, it is only natural that he disagrees with us, even when we do no more than to explicate those cases. The discussion of ours that Professor Imwinkelried finds "reminiscent" of a bygone era and a failed theory presents much the same view that was expressed by a unanimous Supreme Court in *Kumho*.²⁹

Understanding this debate requires some understanding of the revolution wrought by *Daubert*. The *Daubert* revolution was largely about one simple, albeit fundamental, change in judicial perspective. Under the predominant rule before *Daubert*, announced in *Frye v. United States*,³⁰ a 1923 opinion of the Court of Appeals for the District of Columbia, courts were expected to evaluate whether the scientific evidence proffered had "gained general acceptance in the particular field in which it belonged."³¹ *Daubert* changed this deference-to-the-field approach to one in which judges themselves have the responsibility to evaluate the basis of expert testimony.³² The gate-

²⁹ See *supra* note 16 and accompanying text.

³⁰ 293 F. 1013 (D.C. Cir. 1923).

³¹ See *id.* at 1014.

³² Opinions in *Frye* jurisdictions sometimes described the scientific literature and considered the validity of the instrumentation or reasoning on which a scientific or technical expert

keeper's job changed, and it became more difficult. Therein lies the revolution. In a nutshell, *Daubert* and its progeny—perhaps especially its progeny—brought the scientific culture to the courtroom. Judges are now expected to bring some critical judgment, informed by knowledge of the way empirical propositions are tested, to expert evidence admissibility decisions.

In addition to making a judge's job intellectually more demanding by shifting the power to declare something adequate for use in court from communities of asserted experts to the judiciary, the move from *Frye* to *Daubert* also raised the height of the admissibility bar. It did so, however, in a more complex way than is often appreciated by courts or commentators. Despite some dicta in *Daubert* stating that the test embodied by Rule 702 is a more liberal one than *Frye*, when compared to the general acceptance test, the *Daubert* test requires more from some fields and less from others depending on the state of the knowledge being offered. *Frye* asks whether something is generally accepted. *Daubert* asks whether it is dependable. These are different questions. Often they will produce the same answer. That happens when the basis of knowledge is weak and a field recognizes it is weak, or when the basis of knowledge is sound and a field recognizes it is sound. But *Daubert* is more liberal when the expert evidence is solid, but on the cutting edge, and therefore not yet generally accepted. Presumably, this is the category Justice Blackmun had in mind when comparing the two tests. On the other hand, *Frye* is more liberal when what is offered is unsound expert evidence that nevertheless has become "generally accepted" in its field.³³ This is the category that judges have encountered in numerous cases in the wake of *Daubert*, and found themselves puzzled about why a supposedly more liberal standard was leading them toward exclusion of evidence that long had been admitted without question.³⁴

The *Frye* test required faith to be placed in various fields and their practitioners, and inevitably made the courts more accepting of speculative, pseudo and sloppy science, but it had the appearance of being easier for judges to administer. *Daubert* requires that fields justify their claims, and this places a heavy cognitive burden on judges. The essential requirement of *Daubert* and its progeny is that to avoid

relied. But under *Frye*, scientific validity was merely circumstantial evidence of the dispositive fact of scientific acceptance. *Daubert* reverses this relationship. Under *Daubert*, general acceptance is merely circumstantial evidence of the dispositive fact of scientific validity. See generally *Daubert v. Merrell Dow Pharm., Inc.*, 509 U.S. 579 (1993).

³³ See 1 FAIGMAN ET AL., *supra* note 2, § 1-3.3, at 5-6 (Supp. 1999) (comparing and contrasting the admissibility of scientific evidence under *Frye* and *Daubert*).

³⁴ The Supreme Court anticipated this problem as well. See *Daubert v. Merrell Dow Pharm., Inc.*, 509 U.S. 579, 597 (1993) ("We recognize that, in practice, a gatekeeping role for the judge, no matter how flexible, inevitably on occasion will prevent the jury from learning of authentic insights and innovations.").

exclusion, experts must offer the courts more than unsupported assertions; they must offer evidence about the basis of their asserted expertise sufficient to enable a judge to conclude that their expert testimony will provide dependable information to the factfinder. *Joiner* rejects testimony that connects the underlying data to a conclusion with nothing more than “the *ipse dixit*” of the expert.³⁵ *Kumho* makes clear that these requirements extend to all kinds of expert testimony; that the expertise that must be proven is not broad and general but specific to the factual issue that the testimony is offered to resolve; and that in appropriate cases, an expert who can support his claims of expertise with nothing better than his “many years of experience,” has not satisfied the requirements for admission. We think all of this makes good sense. It should help insure that expert evidence will be more often informative than misleading. Professor Imwinkelried thinks that it asks too much of experts and deprives the courts of what he trusts will more often be helpful than fallacious.

IV. THE CONTOURS OF A BETTER EVIDENCE ANALYSIS

With this background, we wish to turn specifically to the contours of a “better evidence” analysis in the context of expert testimony. Our purpose is two-fold: to outline where the courts are today and to offer tentative thoughts on the direction the courts should take in the future. The first point to be made is that the question of whether courts should adopt a better evidence analysis does not have a single answer. Rather, the issue must be understood within the context of the specific situation in which it arises. There are at least three different contexts in which better evidence questions arise: (1) a requirement, over time, that better evidence be offered as a result of theoretical, methodological, or technological advances; (2) a requirement in the context of a particular lawsuit that admissible expert opinions must rest on “better evidence;” and (3) requiring a minimal threshold of reliability.

A. *Better Evidence in the Face of Advances in Knowledge*

As better techniques develop, what was once acceptable may become insufficient and inadmissible. For example, prior to the ability to measure the concentration of alcohol in the bloodstream, driving while intoxicated was criminalized without a precise definition of “intoxication.”³⁶ As techniques to measure blood and breath alcohol

³⁵ See 1 FAIGMAN ET AL., *supra* note 2, § 1-3.5, at 17-22 (Supp. 1999) (analyzing the deferential standard of review for the admissibility of expert testimony adopted by the Court in *Joiner*).

³⁶ See, e.g., Robert J. Scheffter, *Under the Influence of Alcohol Three Hours After Driving*, 100 DICK. L. REV. 441, 444 (1996) (noting that Pennsylvania passed its first DUI statute in 1909 without a precise definition of the term “intoxication”).

content emerged, in many jurisdictions the very definition of the offense changed to driving with blood or breath alcohol levels exceeding specified minima. Under these laws, testimony that once may have been admissible—for example, testimony that the defendant looked like he was drunk and had the odor of alcohol on his breath—may no longer be so in the absence of some type of chemical, biochemical, or gas chromatographic test and the testimony of someone skilled in its use.³⁷

Likewise, theoretical advances may turn the once admissible into the inadmissible. At one time there were a substantial number of cases in which experts were permitted to testify that a single trauma could cause cancer.³⁸ Most of these cases arose prior to a genetic theory of cancer. Today, there is little theoretical or empirical support for this association, and experts are rarely, if ever, permitted to testify that a mechanical trauma causes cancer.³⁹

These examples suggest that evidence law, including the standards governing the admissibility of expert evidence, will change with advances in science and other areas of expertise.⁴⁰ This rather modest point is true regardless of the choice of admissibility tests. However, it may be that the movement from *Frye* to *Daubert* accelerates this process. When courts and commentators say that the *Daubert* test is a more liberal admissibility rule, they are usually thinking of situations where an expert wishes to testify about cutting-edge science that has not as yet reached general acceptance. When an expert purports to testify on the basis of an older paradigm, however, the *Frye* test may be more liberal because it enshrines older understandings when it has yet to be generally recognized that more recent developments have undermined them. Because *Daubert* requires that

³⁷ See ANDRE A. MOENSSSENS ET AL., SCIENTIFIC EVIDENCE IN CIVIL AND CRIMINAL CASES 212, 220 (4th ed. 1995) (discussing the legal aspects of chemical tests for determining alcohol intoxication).

³⁸ See, e.g., *Menarde v. Philadelphia Transp. Co.* 103 A.2d 681 (Pa. 1954) (holding that expert testimony established a causal connection between a street car accident and a passenger's breast cancer); *Daly v. Bergstedt*, 126 N.W.2d 242 (Minn. 1964) (holding that a causal connection between accident trauma and development of cancer was established by expert testimony).

³⁹ See generally Marvin M. Romsdahl, *Trauma and Cancer*, in PHANTOM RISK: SCIENTIFIC INFERENCE AND THE LAW 359 (Kenneth R. Foster et al. eds., 1995) (examining the perceived relationship between trauma and cancer); Samuel R. Gross, *Expert Evidence*, 1991 WIS. L. REV. 1113, 1184 ("By 1960, medical doctors did not seriously dispute that a single traumatic blow could not cause a malignant tumor. . .").

⁴⁰ Substantive areas of law may be similarly affected. For example, the likelihood of medical malpractice increases as medical knowledge grows. Only after doctors know how to detect and treat illness effectively is the failure to do so negligent. Indeed an analogy can be drawn to the shifting standards of expertise in tort law. See Mark F. Grady, *Why Are People Negligent? Technology, Nondurable Precautions, and the Medical Malpractice Explosion*, 82 NW. U. L. REV. 293 (1988) (arguing that advances in technology can cause corresponding increases in the frequency of negligence claims).

"[p]roposed testimony must be supported by appropriate validation—*i.e.*, 'good grounds,' based on what is known,"⁴¹—it provides litigants with a powerful argument that testimony that continues to be generally accepted in the scientific community is no longer admissible.

Global changes such as these are important examples of how law responds to increases in knowledge, but they are not at the heart of Professor Imwinkelried's critique. He is more concerned with the potential use of better evidence principles in the context of specific litigation. It is to this second category that we now turn.

B. A Better Evidence Requirement in Specific Litigation

Even within the context of specific litigation, what we might mean by a better evidence principle varies depending on the state of scientific and other expert knowledge. It is useful to distinguish the application of the principle in three situations: (a) a requirement that experts base their opinion, at least in part, on better evidence when it is available; (b) a requirement that experts base their opinion on better evidence even when it is not currently available; and (c) a requirement that evidence meet some minimal threshold of reliability. In discussing these situations, we draw examples from the toxic tort and drug cases where courts clearly have applied something resembling a better evidence principle.⁴²

1. Requiring Better Evidence When It Is Available

Beginning with Judge Weinstein's opinion in the *Agent Orange* litigation,⁴³ courts have frequently expressed a preference for epidemiological evidence over other types of evidence such as animal studies. Judge Weinstein was quite forceful in his comments concerning animal studies:

The many studies on animal exposure to Agent Orange, even plaintiffs' expert concedes, are not persuasive in this lawsuit.
... There is no evidence that plaintiffs were exposed to the

⁴¹ *Daubert v. Merrell Dow Pharm., Inc.*, 509 U.S. 579, 590 (1993).

⁴² Professor Imwinkelried acknowledges this state of affairs in his article. *See, e.g.*, Imwinkelried, *supra* note 3, at 41 ("[W]hen the proponent proffers a non-specific [gas chromatography] test but it clearly would have been feasible to conduct a specific gas chromatography/mass spectrometry (GC/MS) test, testimony about the TLC test would be inadmissible.").

⁴³ *See generally In re "Agent Orange" Prod. Liab. Litig.*, 611 F. Supp. 1223 (E.D.N.Y. 1985), *aff'd*, 818 F.2d 145 (2d Cir.1987). A preference for epidemiological evidence also can be found in earlier cases. For instance, in *Heyman v. United States*, a "swine flu" case, the District Court dismissed the complaint because "[g]iven the general inability of a physician to make accurate predictions of causation without at least some reference to epidemiological studies, plaintiff's position that her illness was caused by the swine flu shot amounts to nothing more than speculation." 506 F. Supp. 1145, 1149 (S.D. Fla. 1981).

far higher concentrations involved in both the animal and industrial exposure studies. The animal studies are not helpful in the instant case because they involve different biological species. They are of so little probative force and are so potentially misleading as to be inadmissible.⁴⁴

This negative assessment was repeated in a substantial number of Bendectin cases leading up to the Supreme Court's ruling in *Daubert*. The most extreme view in favor of excluding other evidence is to be found in *Brock v. Merrell Dow Pharmaceuticals, Inc.*⁴⁵ In overturning a jury verdict for plaintiff, the Court of Appeals for the Fifth Circuit deemed the "failure to present statistically significant epidemiological proof that Bendectin causes limb reduction defects to be fatal to [the] case."⁴⁶ More modest positions are to be found in *Lynch v. Merrell-National Laboratories*⁴⁷ and *Richardson v. Richardson-Merrell, Inc.*⁴⁸ In these cases the courts based their decisions on Federal Rule of Evidence 703, concluding that testimony on human teratogenicity based on structure-activity, *in vitro*, or animal studies was not of the "type reasonably relied upon by experts in the particular field" and therefore inadmissible.⁴⁹ The key to *Richardson* is in its comparative analysis. The court essentially held that these other types of data cannot form a sufficient foundation when substantial epidemiological evidence exists.⁵⁰ Most courts that considered the issue in the Bendectin context gave some preference to epidemiological evidence, but the nature of their preference was not identical and this position was not unanimous. For example, the district court in *Longmore v. Merrell Dow Pharmaceuticals, Inc.*⁵¹ maintained that:

Animal studies are generally relied upon by experts determining the link between a drug and birth defects and the same is true for chemical analysis. While the Court will leave open the question of the admissibility of particular studies

⁴⁴ *In re "Agent Orange,"* 611 F. Supp. at 1241 (citation omitted).

⁴⁵ 874 F.2d 307 (5th Cir.), *modified*, 884 F.2d 166 (5th Cir. 1989).

⁴⁶ *Brock v. Merrell Dow Pharm., Inc.*, 884 F.2d 166, 167 (5th Cir. 1989). The court explained that "[w]hile we do not hold that epidemiologic proof is a necessary element in all toxic tort cases, it is certainly a very important element. This is especially true when the only other evidence is in the form of animal studies of questionable applicability to humans." *Id.* at 313.

⁴⁷ 646 F. Supp. 856 (D. Mass. 1986), *aff'd*, 830 F.2d 1190 (1st Cir. 1987).

⁴⁸ 857 F.2d 823 (D.C. Cir. 1988).

⁴⁹ *See Lynch*, 646 F. Supp. at 866-67 (quoting Federal Rule of Evidence 703). Whether Rule 703 supports this interpretation is open to doubt. The rule, after all, is merely a liberalization of the common law practice that required an expert to rely on facts that he had witnessed or that had been or would be proved by other admissible testimony.

⁵⁰ *See Richardson*, 857 F.2d at 832.

⁵¹ 737 F. Supp. 1117 (D. Idaho 1990).

during the trial of this matter, the Court cannot now preclude all such studies under Rule 703.⁵²

If we understand Professor Imwinkelried correctly, he disapproves of the opinions that privilege epidemiological evidence. He would more nearly agree with the district court in *Longmore* than the courts of appeals in *Brock*, *Richardson*, and *Lynch*.

How would a "better evidence principle" work in this context? It would attend to three variables—the quality of the epidemiological evidence, the bases of an expert's testimony, and the nature of the expert's conclusion. Suppose that there is a rich body of epidemiological evidence, as in the Bendectin litigation,⁵³ that an expert offers an opinion on whether the substance causes the injury in question, but that the expert does so without reasonably incorporating the epidemiological data. In this circumstance, the court's refusal to permit the expert to testify is reasonable.⁵⁴

However, this consideration of "better evidence" does not prohibit an expert from testifying about animal research. It would not support a ruling that all testimony on animal research is inadmissible just because there is some epidemiological evidence to the contrary.⁵⁵

⁵² *Id.* at 1121; see also *In re Bendectin Prod. Liab. Litig.*, 732 F. Supp. 744, 748-49 (E.D. Mich. 1990) (denying motion for summary judgment based on a lack of epidemiological evidence and allowing plaintiff to present alternative scientific studies).

⁵³ See generally MICHAEL D. GREEN, *BENDECTIN AND BIRTH DEFECTS: THE CHALLENGES OF MASS TOXIC SUBSTANCES LITIGATION* (1996); JOSEPH SANDERS, *BENDECTIN ON TRIAL: A STUDY OF MASS TORT LITIGATION* (1998). For other substances as to which a substantial body of epidemiological research exists, see *Allen v. Pennsylvania Eng'g Corp.*, 102 F.3d 194, 195 (5th Cir. 1996) (ethylene oxide); *Conde v. Velsicol Chem. Corp.*, 804 F. Supp. 972, 977 (S.D. Ohio 1992), *aff'd*, 24 F.3d 809 (6th Cir. 1994) (chlordane); *Nelson v. American Sterilizer Co.*, 566 N.W.2d 671, 672 (Mich. Ct. App. 1997) (ethylene oxide); HANS ZEISEL & DAVID KAYE, *PROVE IT WITH FIGURES: EMPIRICAL METHODS IN LAW AND LITIGATION* 57-68 (1997) (tobacco smoke, asbestos, and low frequency electromagnetic radiation).

⁵⁴ The grounds for exclusion have largely shifted after *Daubert*. Pre-*Daubert* opinions tended to rely on a Rule 703 analysis. Post-*Daubert* opinions tend to rely on a Rule 702 analysis, an approach that seems more in keeping with the structure and purposes of these different rules. In *Raynor v. Merrell Pharmaceuticals, Inc.*, 104 F.3d 1371 (D.C. Cir. 1997), the Court of Appeals concluded that it was not methodologically sound to infer from chemical structure, in vivo animal studies, and in vitro studies, that Bendectin causes human birth defects, even though the epidemiological evidence was to the contrary. Compare *Allen*, 102 F.3d at 196-98 (excluding the expert's testimony under Rule 702, but also recognizing Rule 703 as an additional grounds for exclusion).

⁵⁵ Why do courts have such a preference for human epidemiological studies over animal experiments? Probably because the problem of external validity (generalizability) is one of the most obvious aspects of research methodology, and therefore one that non-scientists (including judges) are able to discern with ease – and then give excessive weight to (because whether something generalizes or not is an empirical question; sometimes things do and other times they do not). But even very serious problems of internal validity are harder for the untrained to see and understand, so judges are slower to exclude inevitably confounded epidemiological studies (and give insufficient weight to that problem). Sophisticated students of empirical research see the varied weaknesses, want to see the varied data, and draw more nuanced conclusions. See generally 1 FAIGMAN ET AL., *supra* note 2, §§ 2-4.0, 2-5.0, at 62-76 (Supp. 1999) (discussing both internal and external validity problems in empirical testing).

The approach does support a refusal to admit expert testimony that a substance causes injury based *solely* on non-epidemiological evidence, at least where the epidemiology is extensive and contrary to the inferences that might otherwise be drawn from the toxicology.⁵⁶

In an effort to sidestep this problem, some experts incorporated their own re-analysis of epidemiological data and offered a minority view as to what the research indicated. The *Richardson* court noted this point with respect to the testimony of Dr. Alan Done, a witness who frequently appeared on behalf of plaintiffs in Bendectin cases:

These three types of studies then—chemical, *in vitro*, and *in vivo*—cannot furnish a sufficient foundation for a conclusion that Bendectin caused the birth defects at issue in this case. Studies of this kind, singly or in combination, are not capable of proving causation in human beings in the face of the overwhelming body of contradictory epidemiological evidence. Perhaps mindful of this, the last type of evidence considered by Dr. Done consisted of the epidemiological studies. When such studies are available and relevant, and particularly when they are numerous and span a significant period of time, they assume a very important role in determinations of questions of causation.⁵⁷

Although the court concluded that Dr. Done's epidemiological work did not provide a sufficient foundation for his opinion,⁵⁸ even in conjunction with the other types of evidence, this conclusion is not part of a "better evidence" analysis. Rather, the court concluded that the re-analysis was unreliable, in large part due to a lack of peer review and publication.⁵⁹ The fate of Dr. Done's testimony does not mean that all testimony based on the re-analysis of another's data and on the review of previous epidemiological research is inadmissible or that it would be excluded under a better evidence approach.

⁵⁶ See, e.g., *Lee v. Richardson-Merrell, Inc.*, 772 F. Supp. 1027, 1032-33 (W.D. Tenn. 1991) (granting defendant's motion for summary judgment on grounds that plaintiff's non-epidemiological expert evidence would be inadmissible). The argument for the admissibility of the toxicology evidence is stronger when the epidemiological findings are more tentative. See Michael D. Green, *Expert Witnesses and Sufficiency of Evidence in Toxic Substance Litigation: The Legacy of Agent Orange and Bendectin Litigation*, 86 NW. U. L. REV. 643, 676 (1992) (criticizing an unquestioning acceptance of the epidemiological studies in one "Agent Orange" case).

⁵⁷ *Richardson v. Richardson-Merrell, Inc.*, 857 F.2d 823, 830 (1988).

⁵⁸ See *id.* at 831-32.

⁵⁹ See *id.* at 831 ("Only by recalculating the data was Dr. Done able to obtain what he deems a statistically significant result. Moreover, the studies rejected by Dr. Done had been published in peer-reviewed scientific journals, while Dr. Done has neither published his recalculations nor offered them for peer review.").

Even within the context of a better evidence principle, courts must decide when the data is sufficient to hold that conclusions based on non-epidemiological evidence are inadmissible. Although it is relatively rare to have a body of epidemiological evidence as rich as in the Bendectin area, such situations often involve a very large number of potential plaintiffs. The most noteworthy current example is the silicone implant litigation.⁶⁰

2. Requiring Better Evidence When It Is Not Available

When *Agent Orange* and *Brock* were handed down, commentators were quick to note that these cases were not adopting a general "better evidence" rule that required epidemiological evidence in all toxic tort cases.⁶¹ Indeed, as noted above, the *Brock* court explicitly said that it was not holding that epidemiological proof always is necessary. It is now clear that courts will not exclude causal opinions based on non-epidemiological evidence in situations where a body of such data does not exist. For example, in *Benedi v. McNeil-P.P.C., Inc.*,⁶² the Fourth Circuit held that the trial judge did not abuse his discretion in allowing the case to go the jury even though the plaintiff had not introduced any epidemiological evidence of the relationship between Tylenol and liver damage.⁶³ Apparently, neither side introduced any epidemiology on point.⁶⁴

⁶⁰ See generally Betty A. Diamond et al., SILICONE BREAST IMPLANTS IN RELATION TO CONNECTIVE TISSUE DISEASES AND IMMUNOLOGICAL DYSFUNCTION, A REPORT BY THE RULE 706 NATIONAL SCIENCE PANEL TO THE HONORABLE SAM C. POINTER JR., COORDINATING JUDGE FOR THE FEDERAL BREAST IMPLANT MULTI-DISTRICT LITIGATION (1998), reprinted in part in 3 FAIGMAN ET AL., *supra* note 2, § 41-2.0 (Supp. 1999) (providing a comprehensive account of the available scientific data on the effects of silicone breast implants); COMMITTEE ON THE SAFETY OF SILICONE BREAST IMPLANTS, INSTITUTE OF MEDICINE, SAFETY OF SILICONE BREAST IMPLANTS (Stuart Bondurant et al. eds., 1999) (same); Joseph Sanders & D.H. Kaye, *Expert Advice on Silicone Implants: Hall v. Baxter Healthcare Corp.*, 37 JURIMETRICS J. 113 (1997) (analyzing the scientific evidence and expert testimony used in one silicone breast implant trial). The Eleventh Circuit questioned the testimony of an expert in a silicone implant case because he did not "explain why the results of these animal studies should trump more than twenty controlled epidemiological studies of breast implants in humans which have found no valid increased risk of autoimmune disease." *Allison v. McGhan Med. Corp.*, 184 F.3d 1300, 1314 (11th Cir. 1999).

⁶¹ See, e.g., Green, *supra* note 56, at 699 ("Epidemiological studies are merely a tool, not a pancea, for finding toxic causation.").

⁶² 66 F.3d 1378 (4th Cir. 1995).

⁶³ See *id.* at 1384-85.

⁶⁴ See *id.*; see also *Ambrosini v. Labarraque*, 101 F.3d 129, 138-39 (D.C. Cir. 1996) (reversing summary judgment for defendant and allowing plaintiff's expert to testify in the absence of epidemiological evidence); *Graham v. Playtex Prod., Inc.*, 993 F. Supp. 127, 132 (N.D.N.Y. 1998) (denying defendant's motion for summary judgment and allowing plaintiff's expert to testify on toxic shock syndrome in the absence of epidemiological evidence); *Pick v. Am. Med. Sys., Inc.*, 958 F. Supp. 1151, 1158 (E.D. La. 1997) (granting defendant's motion for summary judgment and noting that while epidemiological studies are a "most useful and conclusive type of evidence," they are not a "necessary element in all toxic tort cases"). This does not mean that a lack of epidemiology is a free ticket to the admission of animal studies to prove causation. The

We believe these cases, too, can be defended with a better evidence principle. First, in the absence of epidemiological evidence, other toxicological evidence is the type of data on which many experts in the area would rely. Undoubtedly, they would prefer to have epidemiological evidence as well, but in making risk assessments for regulatory purposes, they are prepared to act in its absence. Thus, the evidence may meet the reliability requirement of *Daubert*.⁶⁵ Second, the better evidence principle is not an absolute rule, but rather a standard that balances the quality of a body of information against the cost of procuring better information. The principle does not punish parties because a specific body of research does not exist.⁶⁶

C. Requiring a Minimal Threshold of Reliability

As Professor Imwinkelried notes, the questions of admissibility and sufficiency are often closely related and in some cases "a proponent's failure to present any expert testimony is fatal to the legal sufficiency of the proponent's case."⁶⁷ He cites cases where courts have held that although admissible, testimony about nonspecific drug identification tests is legally insufficient to establish the substance's identity. In many situations, however, it would be unwise to draw too sharp a line between sufficiency and admissibility. To use a toxic tort example, "structure-activity" evidence can suggest that a substance causes an injury: the substance to which the plaintiff was exposed has a certain chemical structure, and other substances with similar structures are known to cause similar injuries. If we assume that this is the only evidence the expert has connecting exposure to injury, most courts would say the evidence is insufficient to support a plaintiff's

studies may have other shortcomings, either in their internal methodology, or in their applicability to the exposure and disease experienced by the plaintiff. The Supreme Court rejected plaintiff's testimony based on an animal study in *General Electric Co. v. Joiner*, 522 U.S. 136 (1997), on such grounds. For additional cases, see 2 FAIGMAN ET AL., *supra* note 2, § 27.1.3.2, at 264-66.

⁶⁵ Or it may not. Other experts have raised serious question about extrapolations from animal studies, and *Daubert* opens up the possibility of deeming such extrapolation an unsound basis for an opinion as to causation in human beings. See 1 FAIGMAN ET AL., *supra* note 2, § 3-2.3.3, at 99 n.43.

⁶⁶ Some recent proposals do just that. For instance, Professor Berger has urged that defendants in toxic tort cases be found liable for a plaintiff's injury even in the absence of causal evidence if the plaintiff could show that the defendant failed to conduct research on potential latent risks. See Margaret A. Berger, *Eliminating General Causation: Notes Toward a New Theory of Justice and Toxic Torts*, 97 COLUM. L. REV. 2117 (1997). From the perspective of this paper, Professor Berger's proposal could be viewed as a requirement that the defendant produce better evidence or suffer an adverse legal consequence. Conversely, if extrapolations from animal data are too fragile to be "good grounds" under *Daubert*, then plaintiffs would bear the burden of losing for want of better evidence than that which is available. In any event, it should be clear that the mere fact that no other evidence is available does not warrant the admission of unreliable evidence.

⁶⁷ Imwinkelried, *supra* note 3, at 39.

verdict. This should not mean, however, that the court must allow the plaintiff to put on her case and then rule the evidence is insufficient in response to a motion for a directed verdict. It is certainly proper for the court to rule that there is inadequate fit between these data and an expert's conclusion that the substance causes an injury, and that it is not scientifically sound for an expert to rely solely on structure-activity evidence to draw a causal conclusion. The failure to present a better variety of testimony is fatal in this situation even though better evidence does not currently exist.

Perhaps the most difficult question for the courts after *Daubert*, *Joiner*, and *Kumho* is under what circumstances they should push the parties to produce better evidence. Currently, the issue presents itself in a number of contexts, including products liability design defect cases and forensic evidence cases involving issues such as handwriting analysis, where courts must decide how much to require of experts. In the design cases, a court must decide whether the expert has gone far enough in creating a prototype of an alternative feasible design to be permitted to testify about the inadequacy of the existing design. A number of courts have concluded that the expert had to produce better evidence in the form of a better model of an alternative design before he would be permitted to testify.⁶⁸

In the forensic context, courts have long admitted a surfeit of expertise with little or no evaluation of the foundation upon which the opinion rests. Now that *Daubert* and *Kumho* insist that judges examine all the experts' research bases to ensure that there is a "there there," courts are beginning to discover that some of these emperors are scantily clad.⁶⁹ Indeed, Professor Imwinkelried joined Professors

⁶⁸ See *Jaurequi v. Carter Mfg. Co.*, 173 F.3d 1076, 1084 (8th Cir. 1999) ("In the case at hand, Willis was prepared to testify that the corn head was unreasonably dangerous because it lacked awareness barriers. However, Willis has not attempted to construct or even draw the suggested device, much less test its utility as a safety device or its compatibility with the corn head's proper function We therefore hold that the district court did not abuse its broad discretion in concluding that the proffered testimony regarding the lack of awareness barriers flunked the reliability prong of *Daubert*."); *Pestel v. Vermeer Mfg. Co.*, 64 F.3d 382, 384 (8th Cir. 1995) (holding that summary judgment for the defendant was proper given the District Court's determination that the plaintiff's expert failed to produce and test a better model of alternative design); see also William J. Brown, Jr., Note, *Expert Testimony in Design Defect Cases*, 37 JURIMETRICS J. 285, 292-300 (1997) (discussing the alternative design test method).

⁶⁹ See, e.g., *United States v. Hines*, 55 F. Supp.2d 62, 68 (D. Mass. 1999) ("Handwriting analysis is perhaps the prototype of a technical field regularly admitted into evidence. But, if I were to apply the *Daubert/Kumho* standards rigorously, looking for such things as empirical testing, rate of error, etc., the testimony would have serious problems.") (citation omitted); *Williamson v. Reynolds*, 904 F. Supp. 1529, 1558 (E.D. Okla. 1995), *aff'd sub nom. Williamson v. Ward*, 110 F.3d 1508 (10th Cir. 1997) ("This court has been unsuccessful in its attempts to locate any indication that expert hair comparison testimony meets any of the requirements of *Daubert*. Not even the 'general acceptance' standard is met, since any general acceptance seems to be among hair experts who are generally technicians testifying for the prosecution, not scientists who can objectively evaluate such evidence.") (emphasis in original).

Margaret Berger and Stephen Saltzburg in an *amicus* brief in *Kumho* in which they urged judicial acceptance of "expert testimony from fields which depend heavily on an expert's experience and his or her subjective judgment based on that experience."⁷⁰ One of their principal arguments was that applying the *Daubert* gatekeeping standard to all experts would have a "staggering" impact on "the admissibility of expert testimony from a wide variety of fields such as the forensic sciences, even though such testimony has been routinely accepted in federal and state courts."⁷¹ Their examples included ballistics, handwriting, bite marks, arson investigation and accident reconstruction, and medical and psychiatric testimony.⁷² Since the Court rejected the Berger-Imwinkelried-Saltzburg approach and extended the gatekeeping function to all experts, we shall see just how staggering an impact this rule will have. Even more important to examine will be the impact of *Kumho*; we now have an opportunity to see what impact *Kumho* will have on fields that have been permitted to supply testimony with little or no empirical testing. If courts begin to exclude such testimony, these fields may well mobilize to produce the data now lacking. If *Daubert* and its progeny have no other effect, this one would be salutary enough.

In each of these areas, the courts must decide how rigorous they wish to be in pushing the parties and their experts toward better evidence. As the design defect cases suggest, however, many courts are willing to reject testimony when it is clear that the expert could create better evidence. We are beginning to see the same trend in the forensic sciences. Simply put, courts are beginning to wonder, if these theories and opinions are testable, *why haven't they been tested?* This curiosity lies at the core of the scientific culture.

The proposed revision of Rule 702 encourages courts to ask such questions.⁷³ The advisory committee notes accompanying the proposed rule lists five factors in addition to the factors listed in *Daubert* that courts have considered when deciding whether testimony is sufficiently reliable to be admitted. The fifth factor is "[w]hether the field

⁷⁰ Brief of *amicus curiae* for Respondants at 5-6, *Kumho Tire Co. v. Carmichael*, 526 U.S. 137 (1999) (No. 97-1709).

⁷¹ *Id.* at 15.

⁷² See *id.* at 15-19 (providing several examples identified in *Modern Scientific Evidence* that enumerate many of the scientific weaknesses of these and other forms of expertise that courts have routinely admitted uncritically).

⁷³ See FED. R. EVID. 702 (Proposed Draft 1999) (stating: If scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify thereto in the form of an opinion or otherwise, provided that (1) the testimony is sufficiently based upon reliable facts or data, (2) the testimony is the product of reliable principles and methods, and (3) the witness has applied the principles and methods reliably to the facts of the case. (proposed language underlined)).

of expertise claimed by the expert is known to reach reliable results.”⁷⁴ If the answer to this question is no, this should weigh heavily against admission of the expert’s testimony.

V. CONCLUSION

We reject the charge that we support a “best evidence” rule with respect to expert witnesses that would radically reshape admissibility decisions under the Federal Rules of Evidence. We agree with Professor Imwinkelried that such a rule would be a mistake. We differ with respect to what we have called a better evidence principle. We believe that in a number of ways, the courts already have adopted this principle and that, by and large, they have used it wisely. They have not used the principle to create impossible burdens for parties who could not under any circumstances produce better evidence. On the other hand, they have used the principle to restrict expert testimony when better evidence is reasonably available.

A better evidence principle promises to produce certain beneficial effects. First, as experts ground their decisions on more probative information that is reasonably available, the accuracy of fact-finding should increase. Second, a better evidence principle will have an impact on whether research is done. In the long run, it may enhance the amount of expert knowledge that can be brought to bear on a problem.

Not only is the rule instrumentally wise, it is within the spirit as well as the letter of *Daubert* and its progeny. At bottom, the *Daubert* revolution is about the relationship between judges and experts, between law and science. As one of us recently has noted, “perhaps the purpose of the rules is simply to hold up a target to the courts; call one the *Frye* target and the other the *Daubert* target. The *Frye* ideal says: do whatever the experts tell you to do. The *Daubert* ideal says: figure out the science yourself.”⁷⁵ Part of figuring it out for yourself is for courts to evaluate science in much the same way as scientists do. *Daubert* invites the judge to step out of the four corners of the evidence presented by the testifying experts and to assess the testimony within the context of the body of available scientific knowledge, made accessible to the court through the explanations of parties’ experts, the presentations of counsel, the court’s independent review of the scientific literature, and, in appropriate cases, court-appointed experts or advisers.

⁷⁴ Fed R. Evid. 702 (Proposed Draft 1999) advisory committee’s note.

⁷⁵ Michael J. Saks, *Merlin and Solomon: Lessons from the Law’s Formative Encounters with Forensic Identification Science*, 49 HASTINGS L.J. 1069, 1139 (1998).

